

# Lepidoptera Pupae



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# Types of Insect Pupae

- **Exarate** - appendages free, functional mandibles present (Decticous) or absent (Adecticous)
- Coleoptera, basal  
Lepidoptera, higher Diptera  
(exarate pupae enclosed in puparium)



Coleoptera



Diptera

Alex Wild

# North American Lepidoptera with Exarate and Decticous Pupae

- Micropterigidae
- Eriocraniidae
- Acanthopteroctetidae



Eriocraniidae

T. Harrison



Acanthopteroctetidae

D. Davis & P. Gentili

# Types of Insect Pupae

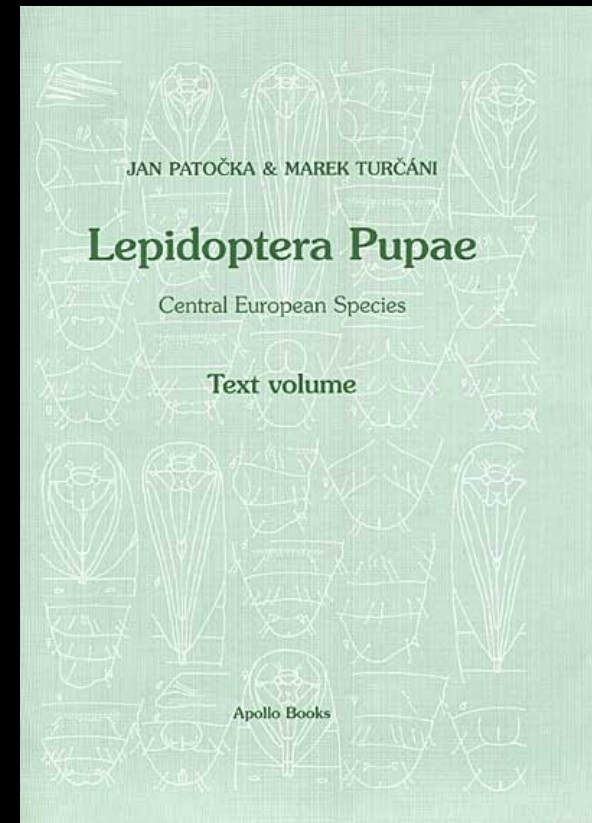
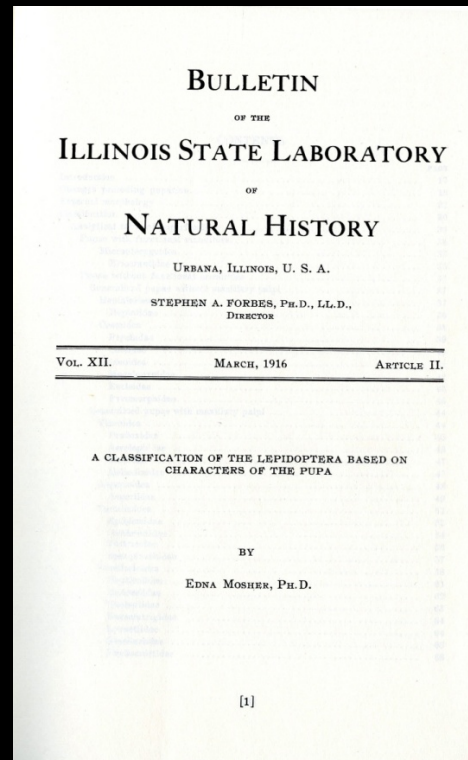
- **Obtect** - appendages fused with body (most Lepidoptera, lower Diptera).
- Some lower grade families, e.g., Tineidae, Gracillariidae, Nepticulidae, and others with appendages weakly fused.





# Major Works on Lepidoptera Pupae

- Edna Mosher, 1916
- Howard Hinton, 1946
- Jan Patočka & Marek Turčáni, 2005



## *Pupae Incompletae*

- less fusion of abdomen segments, more movable.



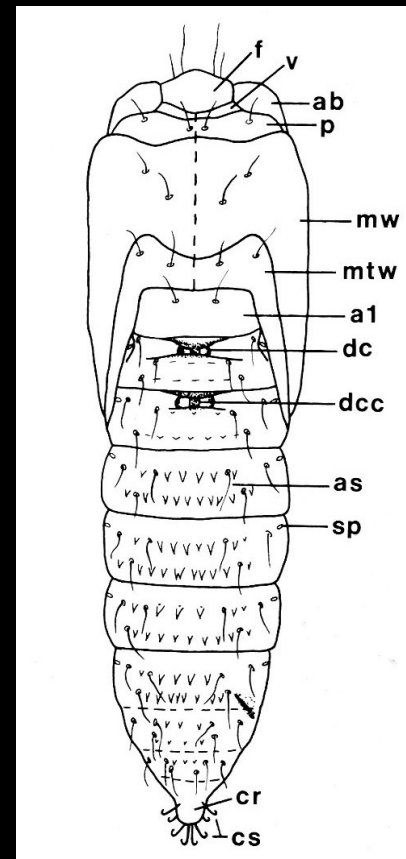
N.A. Martin

## *Pupae Incompletae*

- push forward out of cocoon during emergence.
- abdominal tergites with spines to aid forward movement.



*Podesia* (Sesiidae) Whitney Cranshaw



## Major groups with *Pupae Incompleta*

- Tineoidea
- Gracillarioidea
- Zygaenoidea
- Cossoidea
- Tortricidae
- Choreutoidea



## *Pupae Completa* (= Obtectomera)

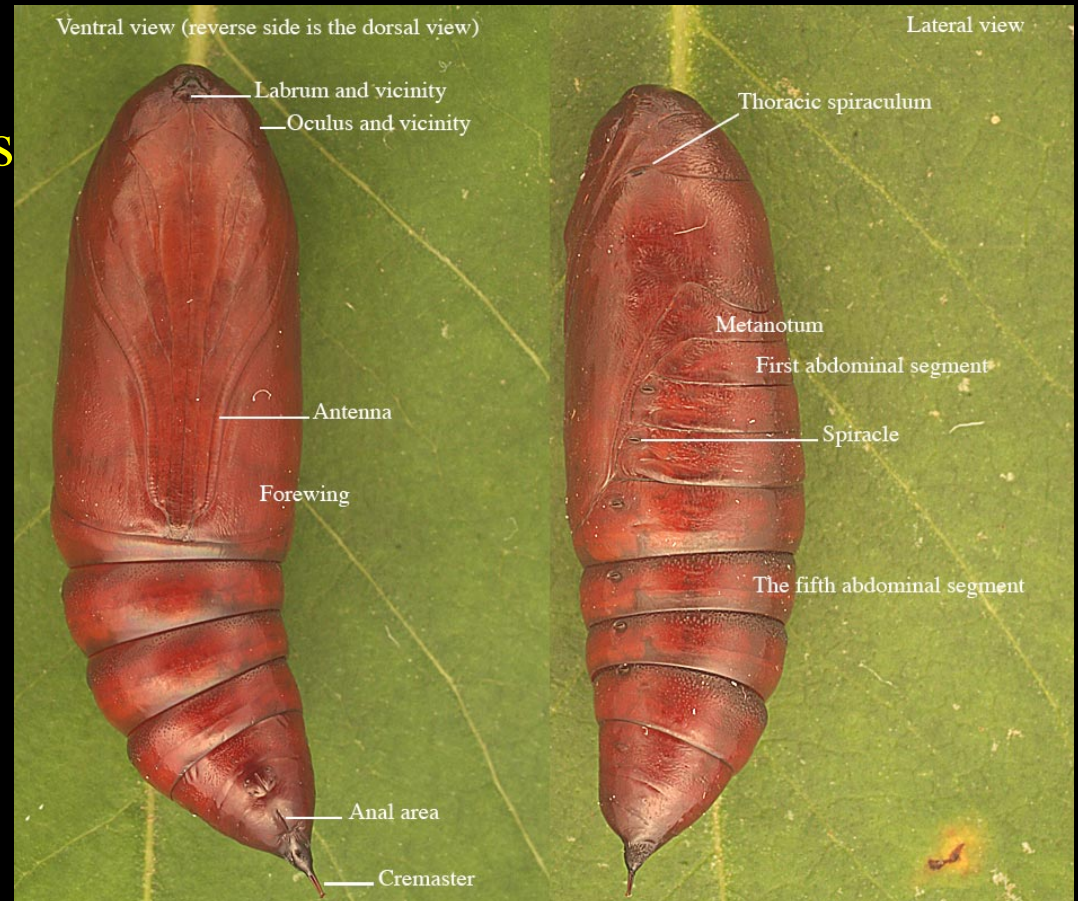
- Pupae with abdominal segments less movable.
- Spines on abdomen absent.
- Pupa not extruding from pupation site.

## Major groups with *Pupae Completa*

- Yponomeutoidea
- Gelechioidea
- Pyraloidea
- Macrolepidoptera

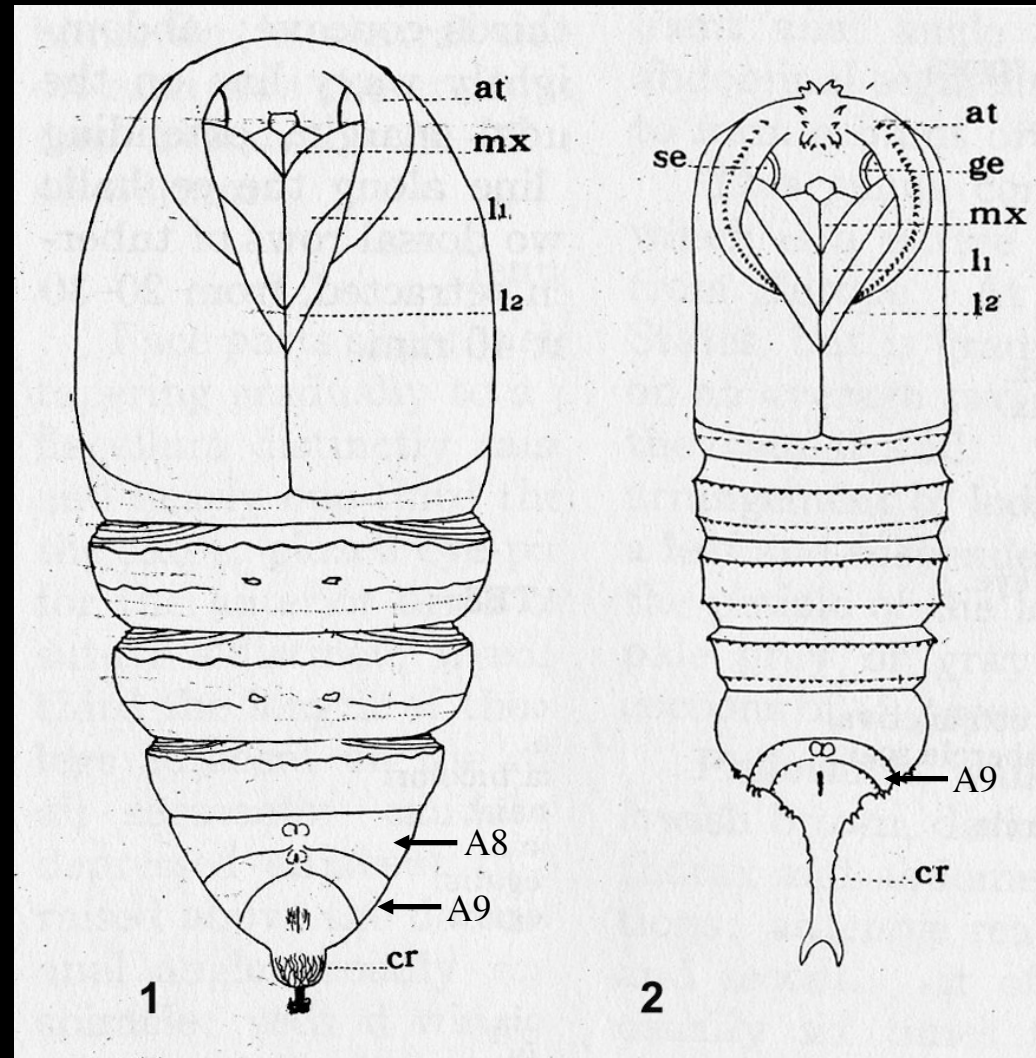
# Pupal Structures

- Head, thoracic segments and appendages identifiable.
- Abdomen with ten segments.



# Sexing Pupae

- A10 with anal slit
- Genital scars on A8 and A9 in female (may be undetectable on A9).
- Genital scars on A9 in male.





# When is a pupa not a pupa?

- Molting involves two steps: **apolysis** (separation of old and new cuticles) and **ecdysis** (shedding of old cuticle).
- Apolysis without ecdysis results in pharate stages.



J. Staake

# When is a pupa not a pupa?

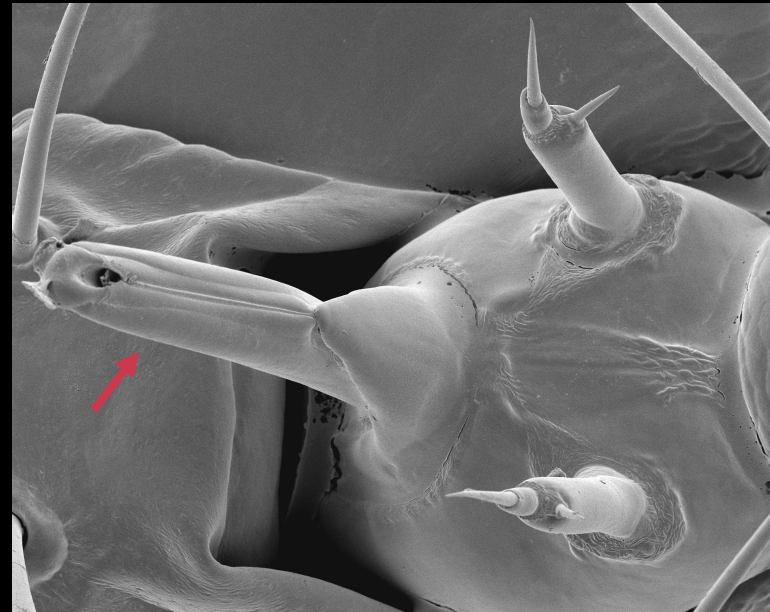
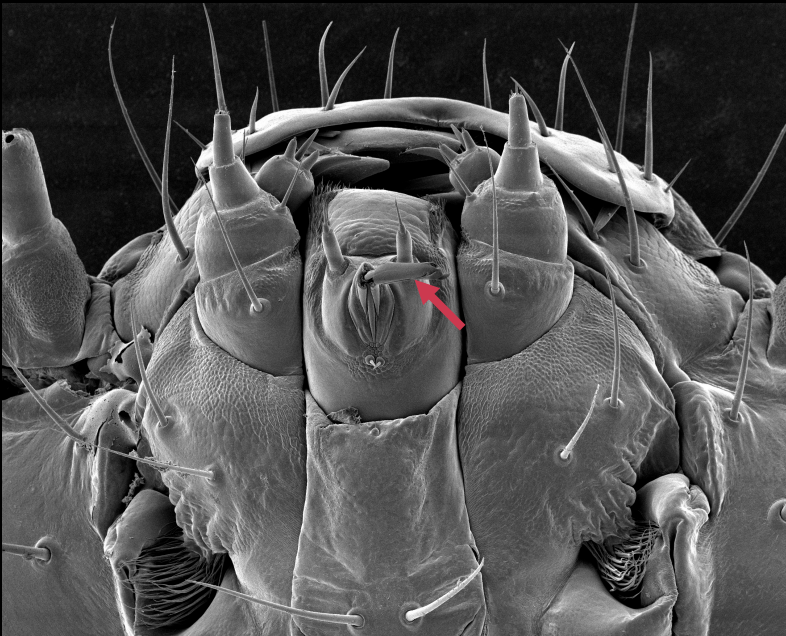
- Metamorphosis based on molting.
- Molting involves two steps: apolysis (separation of old and new cuticles) and ecdysis (shedding of old cuticle).
- Apolysis without ecdysis results in pharate stages.
- The **Diptera puparium** is a pharate pupa within the larval skin.
- **Lepidoptera** often have pharate pupae or pharate adults.



J. Staake

# Cocoons

- Silk produced by larval labial glands and extruded by spinnerets.
- Labial glands with multiple functions, e.g. work of Gary Felton.



# Cocoons

- Many species without cocoons, e.g., Papilionoidea, some Tortricidae.
- Many in soil cavities without cocoons, e.g., some Sphingidae, Notodontidae, and others.





# Cocoons

- Variations in cocoons:

Ribbed cocoons: Buccalatricidae.



Terry Harrison, [microleps.org](http://microleps.org)

# Cocoons

- Variations in cocoons:

Transparent, thin cocoons: e.g., Gracillariidae



Terry Harrison, [microleps.org](http://microleps.org)

# Cocoons

- Variations: Lacework cocoons



Terry Harrison, [microleps.org](http://microleps.org)

Acrolepiidae



Urodidae



# Cocoons

- Variations: Larval setae



Tim Cockerill



John Horstman



John Horstman

Erebidae: Arctiinae



# Cocoons

- Variations in cocoons:

- Single and double wall cocoons
  - with and without leaf coverings, e.g., Saturniidae.



Shay, Deviant Art



# Cocoon Rattles



Ric Peigler

# Summary

- Exarate and Obtect Pupae.
- Exarate pupae dectitious in basal families.
- Obtect pupae divided into Incompleta and Completa (Obtectomera).
- Silk cocoons present or absent with variations.